Invoice

Moffatt & Nichol
P.O. Box 22648
Long Beach, CA 90801-5648
Phone: (562) 590-6500

Robert Law
De Maximis Inc.
186 Center Street, Suite 290
Clinton, NJ 08809

September 26, 2012
Invoice No: 62273

Project 6664 Lower Passaic River Restoration Modeling Work - Initial Tasks

Professional Services from July 29, 2012 to August 25, 2012

Phase I LPR/NB RI/FS Modeling Program TOM5

Task 01 Project Management

Professional Personnel

	Hours	Rate	Amount	
Engineer/Scientist III				
Canizares, Rafael	34.00	185.00	6,290.00	
Totals	34.00		6,290.00	
Total Labor				**6,290.00**
			Total this Task	**$6,290.00**

Task 02 Data Analysis & Monitoring Design Coordination for Use In Numberical Model

Professional Personnel

	Hours	Rate	Amount	
Engineer/Scientist II				
Mathew, Rooni	21.00	164.00	3,444.00	
Support Staff Engineer				
Manian, Dinesh	24.00	90.00	2,160.00	
CADD II				
Chibisova, Yelena	51.00	96.00	4,896.00	
Totals	96.00		10,500.00	
Total Labor				**10,500.00**
			Total this Task	**$10,500.00**

Task 03 System Understanding

Professional Personnel

	Hours	Rate	Amount	
Support Staff Engineer				
Manian, Dinesh	72.00	90.00	6,480.00	
Totals	72.00		6,480.00	
Total Labor				**6,480.00**
			Total this Task	**$6,480.00**

Task 04 LPR/NB Hydrodynamic Modeling

Professional Personnel

	Hours	Rate	Amount	
Engineer/Scientist III				
Canizares, Rafael	16.00	185.00	2,960.00	
Totals	16.00		2,960.00	
Total Labor				**2,960.00**

				Total this Task	**$2,960.00**

Task 05 LPR/NB Sediment Transport Modeling

Professional Personnel

	Hours	**Rate**	**Amount**	
Engineer/Scientist II				
Mathew, Rooni	31.00	164.00	5,084.00	
Support Staff Engineer				
Manian, Dinesh	64.00	90.00	5,760.00	
Totals	95.00		10,844.00	
Total Labor				**10,844.00**
			Total this Task	**$10,844.00**

Task 07 LPR/NB Contaiminant Fate and Transport Modeling

Professional Personnel

	Hours	**Rate**	**Amount**	
Engineer/Scientist II				
Mathew, Rooni	86.50	164.00	14,186.00	
Staff Engineer/Scientist				
Xiong, Yi	160.00	114.00	18,240.00	
Totals	246.50		32,426.00	
Total Labor				**32,426.00**
			Total this Task	**$32,426.00**

Task 08 Developing LPR/NB Modeling TOM3 SOW, Schedule and Budget

Professional Personnel

	Hours	**Rate**	**Amount**	
Engineer/Scientist III				
Canizares, Rafael	22.00	185.00	4,070.00	
Engineer/Scientist II				
Mathew, Rooni	11.00	164.00	1,804.00	
Totals	33.00		5,874.00	
Total Labor				**5,874.00**
			Total this Task	**$5,874.00**

Task 10 Computer Support

Professional Personnel

	Hours	**Rate**	**Amount**	
Engineer/Scientist II				
Mathew, Rooni	8.50	164.00	1,394.00	
Totals	8.50		1,394.00	
Total Labor				**1,394.00**
			Total this Task	**$1,394.00**
			Total this Phase	**$76,768.00**
			TOTAL THIS INVOICE	**$76,768.00**

Please remit payment of this invoice to:

Moffatt & Nichol
ABA #121000248
Account #4159349729
Wells Fargo Bank
111 W. Ocean Blvd., Suite 300
Long Beach, CA 90802 USA

Project	6664	Lower Passaic River Restoration	Invoice	62273

Billing Backup

Moffatt & Nichol

Invoice 62273 Dated 9/26/2012

Project 6664 Lower Passaic River Restoration Modeling Work - Initial Tasks

Phase I LPR/NB RI/FS Modeling Program TOM5

Task 01 Project Management

Professional Personnel

			Hours	Rate	Amount	
Engineer/Scientist III						
1548	Canizares, Rafael	8/11/2012	4.00	185.00	740.00	
1548	Canizares, Rafael	8/11/2012	12.00	185.00	2,220.00	
1548	Canizares, Rafael	8/18/2012	3.00	185.00	555.00	
1548	Canizares, Rafael	8/18/2012	1.00	185.00	185.00	
1548	Canizares, Rafael	8/18/2012	2.00	185.00	370.00	
1548	Canizares, Rafael	8/25/2012	12.00	185.00	2,220.00	
Totals			34.00		6,290.00	
Total Labor						**6,290.00**
					Total this Task	**$6,290.00**

Task 02 Data Analysis & Monitoring Design Coordination for Use In Numberical Model

Professional Personnel

			Hours	Rate	Amount	
Engineer/Scientist II						
2219	Mathew, Rooni	8/4/2012	2.00	164.00	328.00	
2219	Mathew, Rooni	8/4/2012	2.50	164.00	410.00	
2219	Mathew, Rooni	8/18/2012	3.00	164.00	492.00	
2219	Mathew, Rooni	8/18/2012	2.00	164.00	328.00	
2219	Mathew, Rooni	8/18/2012	5.00	164.00	820.00	
2219	Mathew, Rooni	8/25/2012	.50	164.00	82.00	
2219	Mathew, Rooni	8/25/2012	5.00	164.00	820.00	
2219	Mathew, Rooni	8/25/2012	1.00	164.00	164.00	
Support Staff Engineer						
2301	Manian, Dinesh	8/4/2012	8.00	90.00	720.00	
2301	Manian, Dinesh	8/4/2012	8.00	90.00	720.00	
2301	Manian, Dinesh	8/4/2012	8.00	90.00	720.00	
CADD II						
2335	Chibisova, Yelena	8/4/2012	38.00	96.00	3,648.00	
2335	Chibisova, Yelena	8/18/2012	13.00	96.00	1,248.00	
Totals			96.00		10,500.00	
Total Labor						**10,500.00**
					Total this Task	**$10,500.00**

Task 03 System Understanding

Professional Personnel

			Hours	Rate	Amount	
Support Staff Engineer						
2301	Manian, Dinesh	8/11/2012	8.00	90.00	720.00	
2301	Manian, Dinesh	8/11/2012	8.00	90.00	720.00	
2301	Manian, Dinesh	8/11/2012	8.00	90.00	720.00	
2301	Manian, Dinesh	8/18/2012	8.00	90.00	720.00	
2301	Manian, Dinesh	8/18/2012	16.00	90.00	1,440.00	
2301	Manian, Dinesh	8/18/2012	8.00	90.00	720.00	
2301	Manian, Dinesh	8/25/2012	8.00	90.00	720.00	
2301	Manian, Dinesh	8/25/2012	8.00	90.00	720.00	
Totals			72.00		6,480.00	
Total Labor						**6,480.00**

					Total this Task	**$6,480.00**

Task 04 LPR/NB Hydrodynamic Modeling

Professional Personnel

			Hours	Rate	Amount	
Engineer/Scientist III						
1548	Canizares, Rafael	8/4/2012	4.00	185.00	740.00	
1548	Canizares, Rafael	8/4/2012	8.00	185.00	1,480.00	
1548	Canizares, Rafael	8/11/2012	4.00	185.00	740.00	
Totals			16.00		2,960.00	
Total Labor						**2,960.00**
					Total this Task	**$2,960.00**

Task 05 LPR/NB Sediment Transport Modeling

Professional Personnel

			Hours	Rate	Amount	
Engineer/Scientist II						
2219	Mathew, Rooni	8/4/2012	2.00	164.00	328.00	
2219	Mathew, Rooni	8/4/2012	1.00	164.00	164.00	
2219	Mathew, Rooni	8/4/2012	1.00	164.00	164.00	
2219	Mathew, Rooni	8/4/2012	1.50	164.00	246.00	
2219	Mathew, Rooni	8/4/2012	2.00	164.00	328.00	
2219	Mathew, Rooni	8/11/2012	1.00	164.00	164.00	
2219	Mathew, Rooni	8/11/2012	4.00	164.00	656.00	
2219	Mathew, Rooni	8/11/2012	2.00	164.00	328.00	
2219	Mathew, Rooni	8/11/2012	2.00	164.00	328.00	
2219	Mathew, Rooni	8/18/2012	2.00	164.00	328.00	
2219	Mathew, Rooni	8/18/2012	3.00	164.00	492.00	
2219	Mathew, Rooni	8/18/2012	1.50	164.00	246.00	
2219	Mathew, Rooni	8/25/2012	2.00	164.00	328.00	
2219	Mathew, Rooni	8/25/2012	4.00	164.00	656.00	
2219	Mathew, Rooni	8/25/2012	2.00	164.00	328.00	
Support Staff Engineer						
2301	Manian, Dinesh	8/4/2012	16.00	90.00	1,440.00	
2301	Manian, Dinesh	8/11/2012	8.00	90.00	720.00	
2301	Manian, Dinesh	8/11/2012	8.00	90.00	720.00	
2301	Manian, Dinesh	8/18/2012	8.00	90.00	720.00	
2301	Manian, Dinesh	8/25/2012	8.00	90.00	720.00	
2301	Manian, Dinesh	8/25/2012	16.00	90.00	1,440.00	
Totals			95.00		10,844.00	
Total Labor						**10,844.00**
					Total this Task	**$10,844.00**

Task 07 LPR/NB Contaiminant Fate and Transport Modeling

Professional Personnel

			Hours	Rate	Amount
Engineer/Scientist II					
2219	Mathew, Rooni	8/4/2012	6.00	164.00	984.00
2219	Mathew, Rooni	8/4/2012	8.50	164.00	1,394.00
2219	Mathew, Rooni	8/4/2012	8.00	164.00	1,312.00
2219	Mathew, Rooni	8/4/2012	5.50	164.00	902.00
2219	Mathew, Rooni	8/4/2012	8.00	164.00	1,312.00
2219	Mathew, Rooni	8/4/2012	7.00	164.00	1,148.00
2219	Mathew, Rooni	8/11/2012	8.50	164.00	1,394.00
2219	Mathew, Rooni	8/11/2012	7.50	164.00	1,230.00
2219	Mathew, Rooni	8/11/2012	5.00	164.00	820.00
2219	Mathew, Rooni	8/11/2012	4.00	164.00	656.00
2219	Mathew, Rooni	8/18/2012	2.00	164.00	328.00
2219	Mathew, Rooni	8/18/2012	3.00	164.00	492.00
2219	Mathew, Rooni	8/18/2012	2.00	164.00	328.00
2219	Mathew, Rooni	8/18/2012	2.00	164.00	328.00
2219	Mathew, Rooni	8/25/2012	3.00	164.00	492.00
2219	Mathew, Rooni	8/25/2012	2.00	164.00	328.00
2219	Mathew, Rooni	8/25/2012	1.00	164.00	164.00
2219	Mathew, Rooni	8/25/2012	1.00	164.00	164.00

2219	Mathew, Rooni	8/25/2012	2.50	164.00	410.00	
Staff Engineer/Scientist						
2403	Xiong, Yi	8/4/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/4/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/4/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/4/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/4/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/11/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/11/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/11/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/11/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/11/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/18/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/18/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/18/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/18/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/18/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/25/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/25/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/25/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/25/2012	8.00	114.00	912.00	
2403	Xiong, Yi	8/25/2012	8.00	114.00	912.00	
Totals			246.50		32,426.00	
Total Labor						**32,426.00**
				Total this Task		**$32,426.00**

Task 08 Developing LPR/NB Modeling TOM3 SOW, Schedule and Budget

Professional Personnel

			Hours	**Rate**	**Amount**	
Engineer/Scientist III						
1548	Canizares, Rafael	8/18/2012	14.00	185.00	2,590.00	
1548	Canizares, Rafael	8/25/2012	8.00	185.00	1,480.00	
Engineer/Scientist II						
2219	Mathew, Rooni	8/18/2012	1.00	164.00	164.00	
2219	Mathew, Rooni	8/25/2012	1.50	164.00	246.00	
2219	Mathew, Rooni	8/25/2012	2.50	164.00	410.00	
2219	Mathew, Rooni	8/25/2012	4.00	164.00	656.00	
2219	Mathew, Rooni	8/25/2012	2.00	164.00	328.00	
Totals			33.00		5,874.00	
Total Labor						**5,874.00**
				Total this Task		**$5,874.00**

Task 10 Computer Support

Professional Personnel

			Hours	**Rate**	**Amount**	
Engineer/Scientist II						
2219	Mathew, Rooni	8/4/2012	1.00	164.00	164.00	
2219	Mathew, Rooni	8/11/2012	5.00	164.00	820.00	
2219	Mathew, Rooni	8/11/2012	1.00	164.00	164.00	
2219	Mathew, Rooni	8/18/2012	.50	164.00	82.00	
2219	Mathew, Rooni	8/18/2012	1.00	164.00	164.00	
Totals			8.50		1,394.00	
Total Labor						**1,394.00**
				Total this Task		**$1,394.00**
				Total this Phase		**$76,768.00**
				Total this Project		**$76,768.00**
				Total this Report		**$76,768.00**

MOFFATT & NICHOL

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New York, NY 10018

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Detailed Description of work done by M&N personnel associated to the LPR/NB Modeling Program Task Order Memoranda 5 - Scope of Work for the period 07/29/2012 to 08/25/2012 M&N Project No. 6664

Hydrodynamics Principal Investigator - Rafael Cañizares.

Task 1 – Project Management	Internal coordination with Deltares and M&N Calls and Coordination with Project Coordinator including prepare material such as Dash Board reports. Prepare and review invoices including revision of Deltares budget and invoices Prepare for Modeling transfer meeting with PC and AQEA Internal coordination. with Project Coordinator for Han Winterwerp visit to NY
Task 4 – LPR/NB Hydrodynamic Model	Address comments and finalize modeling update presentation for TC meeting Prepare modeling update presentation for TC meeting Prepare Modeling transfer meeting with Project Coordinator and AQEA
Task 8 – Developing LPR/NB Modeling TOM6 SOW, Schedule and Budget	Development of new combined SOW and budget for new Modeling Team Conference calls with AQEA to discuss SOW and task distribution

Rooni Mathew.

Task 2 – Data Analysis	Discuss with HQI potential effect from weekend storm on low-flow event, develop HD/ST sensitivity runs to examine potential effect Review HD/ST sensitivity runs to examine potential effect of weekend storms on planned low-flow event, discuss with HQI Review and send shear stress maps to Windward, review SSP data analysis High-vol QAPP response to AECOM Review PWCM data and prior analysis Discuss list of COPC patterns with D.Manian Review CWCM low-flow/spring-tide event plan, review SSP data analysis, develop. list of COPC patterns and discuss with R.Canizares
Task 5 – LPR/NB	Attend TC meeting

Sediment Transport Modeling	Debug tide BC for late 2005 spike, restart hydro runs for gcm_tran Edit presentation for TC meeting per John Connolly and Rob Law comments Review sensitivity run with less frequent consol. model calls Develop presentation for modeling meeting AQEA/dmi/mab Discuss skin friction calculations with Windward, review instabilities in projection runs, review crash with HQI ST runs, correct run script and restart FFS Alt 3 run Review Irene and Mar 2010 skin frictions for MG, review instability bug/cause in projection run Review tide BC in 2005, redo hydro runs Develop ST calibration/validation task list, code changes and run for non-cohesive routines consistency with CPG GSD Review changes to script for EPA ST run, review output Review new calibration runs status Debug crashes with EPAruns, and FFS Alt 3 run Debug ST run crash with EPA ST post-dredge run, review ST model results to support RCA tidal pumping debugging efforts Review ST model status with H. Winterwerp
Task 7 – LPR/NB Contaminate Fate and Transport Modeling	Attend TC meeting, implement fluff layer in RCATOX Edit presentation for TC meeting per J. Connolly and R.Law comments, review RCATOX sensitivity runs, develop HSED MIN/MAX sensitivity run Final code changes for bed layering, code changes to output exact 6" depth-interval concentration Implement fluff layer in RCATOX, start final runs for TCDD with original and rev codes Review RCATOX sensitivity runs, review bed mass balance for revised code (COPC mass, bed thickness) Start PCB77 and Hg bed layering sensitivity runs, debug bed COPC spike in late 2005, Implement fluff layer in RCATOX Develop presentation for modeling meeting with AQEA/dmi/mab Attend Modeling meeting with AQEA/dmi/mab Review Hg model setup changes, review Hg runtime test results, send model BCs to AQEA, compile code/inputs for AQEA Review mercury model setup with Y.Xiong, develop. list of ongoing/proposed tasks for AQEA Review code changes for tidal pumping loss debugging Review mercury changes and results, review problem/debugging w YX for tidal pumping loss in runs with no mixing to top layer Review mercury code/input changes

	Review mercury runtime debugging Conference call with AQEA to discuss CFT SOW, discuss CFT status with L. Postma Review model debugging for tidal pumping loss Review RCATOX tidal pumping debugging efforts Review RCATOX tidal pumping debugging efforts, discuss analysis of final Hg run w Y.Xiong Review RCATOX tidal pumping debugging efforts, review final Hg runs corr. for runtime issues
Task 8 – Developing LPR/NB Modeling TOM6 SOW, Schedule and Budget	Review SOW for new TOM Conference call to discuss SOW w AQEA Develop list of ongoing and proposed modeling tasks and send to AQEA Review and edit new SOW with additional detail on ST tasks
Task 10 – Computer Support	Debug 3rd HDD not visible on new machines Debug hard disk issues w HP tech support, upgrade BIOS, etc Discuss hard disk issue w HP technician & review fix Correct ports for 3rd hard-disk on new machines Mount new hard disks on new machines and network to entire Linux network

Dinesh Manian

Task 2 – Data Analysis	CWCM data analysis (first 3 deployments): Updating maps with revised station coordinates from AECOM; Classifying data in plots based on how measurements were flagged CWCM monitoring design: Predicting effect of a short duration 2500 cfs flood on the salinity front and TSS in the river, and also on gross bed erosion and deposition; CWCM monitoring design: Predicting effect of a short duration 2500 cfs flood on the salinity front in the river; Making simulations with different storm durations and occurring at different phases of tide to see impact on salinity;
Task 3 – System Understanding	Support for Marcia and Windward: Extracting maximum model skin friction for Mar2010 and Irene storm events; Extracting long term average shear stress based on 20 yr hindcast estimates Using updated post-dredge 1949 bathymetry to plot transects, and to re-delineate contaminant groups. Using updated post-dredge 1949 bathymetry to re-delineate contaminant groups. Delineation of contaminant groups based on historical bathy; Analysis of contaminant cores from 1995,08-09 and 2012 datasets; Understanding contaminant distribution;

	Delineation of contaminant groups based on updated historical bathy; Analysis of contaminant cores from 1995,08-09 and 2012 datasets; Understanding contaminant distribution; Delineation of contaminant groups based on updated updated historical bathy; Analysis of contaminant cores from 1995,08-09 and 2012 datasets; Understanding contaminant distribution; Investigating exceptions and outliers in the contaminant distribution; Effect of now demolished bridge on sedimentation in the 60s between RM4.5-5 Plots of contaminant concentrations against historical bathy range, recent sedimentation (2007-2008), Cs peak and percent fines to help explain the contaminant distribution
Task 5 – LPR/NB Sediment Transport Modeling	Testing consolidation code change to improve simulation time; Investigating possible error in code responsible for unstable bed behavior Fixing code bug in sediment transport in wetting/drying (external hydro) Fixing code bug in sediment transport in wetting/drying; Running long term sediment transport with HQI inputs and code Relaunching long term sedtran runs with code bug fixes and speed-ups; Investigating effect of code changes on model results; Analysis of sediment budget/movement in the long and short terms in the calibration run Simulating 1949 post-dredge conditions using HQI code and inputs; Running diagnostics to investigate erosion of the consolidated layers in the M&N calibration run

Yi Xiong

Task 7 – LPR/NB Contaminate Fate and Transport Modeling	Boundary TCDD Mass calculation; Boundary TSS mass calculation. calculate the top 6" average TCDD for cell (16,100); whole domain; whole navigation channel; lower miles navigation channel. Do bed cohesive and noncohesive sediment 15 year change; do 15 hear boundary tcdd mass inflow and outflow. Do the calculation for Cs; check the boundary TCDD mass and boundary TSS mass. Mass balance check for revised code run; Select cell 16,100 for the particle mixing rate test; do tcdd 15year mass change in bed. Discuss the Mercury simulations and code; do more run test.

	Test Mercury run and try to get Hg output when set only one active metal. Do some research on metal speciation in RCATOX. Work on a Mercury Test Runs to test the runtime. Work on excel spread and run the scripts to generate output data; correct linux scripts; revise excel spreadsheet for mass balance calculation. Work on linux script for generating sediment bed contaminant mass, 6" averaged concentration, and deposition erosion diffusion mass transfer. Check the Hg run results. Set up a program to get the important outputs. Discuss the 17,139 simulation results; modify the code to get outputs for future analysis. Modify the input generation program and re-generate MERCURY input files; Modify the RCATOX code; Testing; Launch 3 runs (original, revised, and revised without top layer particle mixing). Modify the subroutine CHEMICALS, re-compile the RCATOX code; do a series of tests to check the results against previous runs. Create an output file to get some time series of a few parameters; Debug the output program. Further modify the plots; Try to give some explanations. Update 15-year Mercury plots; Explain 6" TCDD MATLAB plots. Verify the outputs; Plot the outputs in MATLAB. Work on MATLAB plots; further explain the 6" TCDD concentration trend.

Yelena Chibisova (CAD)

Task 2 – Data Analysis	Digitize historical bathymetries 1949 and 1932 post dredged from RM 5.5 to RM 8